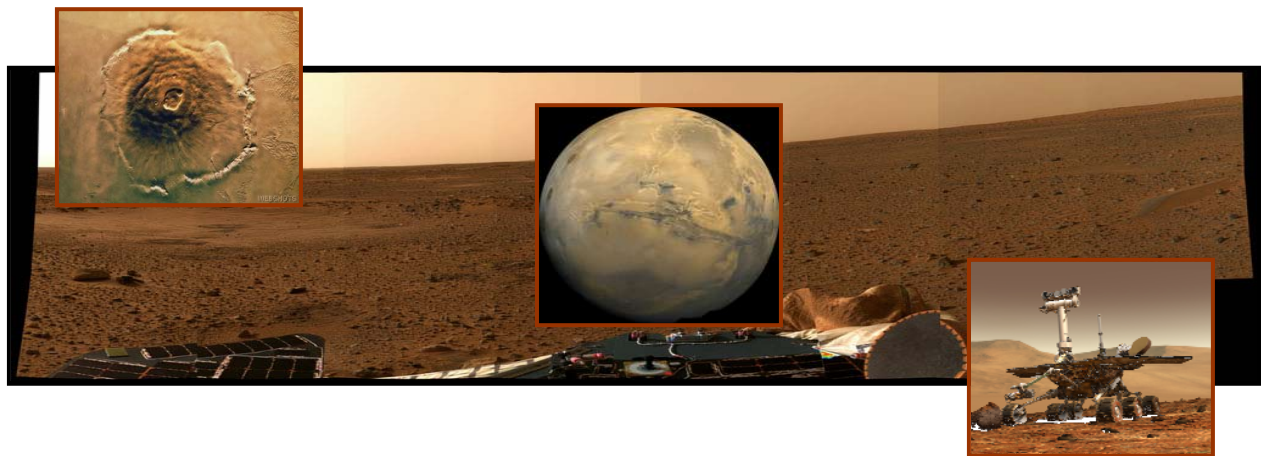




Mission to Mars Challenge

A Digital Learning Network Experience



Designed To Share

The Vision for Space Exploration

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Digital Learning Network (DLN) Challenge

A DLN Challenge is an in-depth research/design experience that allows students to propose solutions to Challenge criteria and present their solutions to NASA through a videoconferencing system. The educational criteria embedded in the Challenge draws from Inquiry-based and Problem Based Learning strategies. A DLN Challenge involves more than one DLN videoconferencing connection, in-depth student involvement through research and design activities, open-ended problem solving flexibility, and formal student presentations that demonstrate understanding and application.

The sequence for a DLN Challenge includes:

- An introduction to the Challenge criteria through a DLN videoconference connection.
- Time for student teams to research, design, and propose solutions to Challenge criteria.
- A final DLN videoconference connection with timed formal student presentations.

This template provides a guideline for developers of DLN Challenges.



Challenge Overview

Grade Level 6 - 12

Focus Question

What type of new challenges does a Mission to Mars present in comparison to a mission to the International Space Station or Apollo Mission?

Instructional Objectives

Students will propose a Mars Spacecraft design.
Students will determine landing site on Mars.

National Standards

National Science Education Standards (NSTA)

Science as Inquiry – Content Standard A

Science and Technology – Content Standard E

National Council of Teachers of Mathematics (NCTM)

Standard 4 – Measurement Standard 8 – Communication

International Technology Education Association (ITEA)

Design – Standard 10

The Designed World – Standard 17

Texas State Standards

Sequence of Events

Pre-Conference Requirements

Online Pre-assessment A pre-assessment tool is available to determine the students' level of understanding prior to the videoconference. Suggested answers are included.

Introduction to Challenge Videoconference

Introduction to Challenge Video-conference (About 45-60 minute conference)

Join NASA in this unique design challenge where students design their very own Crew Exploration Vehicle or pinpoint the safest and best location for a Mars landing. They will have the opportunity to get an in depth look at how current NASA scientists are approaching the very same problems. So hop aboard and join us as we brief your students to meet their objective of producing a successful mission to Mars. Experience the team planning and design challenges needed to carry through a design for a successful mission in the world of planetary exploration.

Introduction to Challenge Videoconference Guidelines

Introduction to Challenge Videoconference Outline

In-Class Research-Design Activities

Challenge criteria applied by students. Enhance your students' understanding of planetary exploration by engaging in this specifically designed learning activity.

Solutions discovered and summarized into Student Presentation

Teams prepare their formal presentations and models in hope that NASA will give them a "GO" for launch!

Content and Presentation Rubric Guidelines. Rubrics are provided for instructor assessment purposes and to help teams identify key objectives that must be met on their presentation.

Presentation of Student Solutions Videoconference

Student Solutions Video-conference (About 45-60 minute conference)

Time has expired and selected teams must present their team's recommendations to NASA. The teams must summarize the experience in a timed oral and visual presentation to NASA.

Presentation of Student Solutions Videoconference Guidelines

Recommendations and expectations provided to help your students prepare for their second connection.

Presentation of Student Solutions Video Conference Outline

Post-Conference Requirements

Online Post-assessment

A post-assessment tool is available to determine changes in student levels of understanding.

NASA Education Evaluation Information System (NEEIS) Feedback Forms

Educator and student feedback forms are available online for all DLN events.



National Standards

National Science Education Standards (NSES)

Science as Inquiry – Content Standard A

As a result of activities in grades 5-8 and 9-12, all students should develop:

- Abilities necessary to do scientific inquiry.
- Understandings about scientific inquiry.

Science and Technology – Content Standard E

As a result of activities in grades 5-8 and 9-12, all students should develop:

- Abilities of technological design.
- Understandings about science and technology.

National Council of Teachers of Mathematics (NCTM)

Standard 4 – Measurement

In all grades students should:

- Apply a variety of techniques, tools, and formulas for determining measurement.

Standard 8 – Communication

In all grades students should:

- Organize and consolidate their mathematical thinking to communicate with others.
- Express mathematical ideas coherently and clearly to peers, teachers, and others.

International Technology Education Association (ITEA)

Design – Standard 10

- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving

The Designed World – Standard 17

- Students will develop an understanding of and be able to select and use information and communication technologies.



Texas Essential Knowledge and Skills

Texas Essential Knowledge and Skills

(8.1) Scientific processes. The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(8.2) Scientific processes. The student uses scientific methods during field and laboratory investigations. The student is expected to:

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(B) collect data and make measurements with precision;

(C) organize, analyze, evaluate, make inferences, and predict trends from data; and

(D) communicate valid conclusions.

(8.3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(C) evaluate the impact of research on scientific thought, society, and the environment;

(8.5) Scientific processes. The student knows that relationships exist between science and technology. The student is expected to:

(A) identify a design problem and propose a solution.

(B) design and test a model to solve the problem

(C) evaluate the model and make recommendations for improving the model.



Pre-Conference Requirements

Online Pre-Assessment

A week before the event, students will need to take the online pre-conference assessment. This short assessment will provide useful background information for the presenters to prepare for the videoconference.

Pre-Conference Assessment Questions

1. How big do dust storms get on Mars?
2. What is the name of the largest canyon on Mars?
3. How come volcanoes can grow so large on Mars?
4. What are the names of the two current rovers exploring Mars?
5. What are the average temperatures on the red planet?
6. What are some of the similarities between Earth and Mars?
7. How long would a trip to Mars take with current technology?
8. What are some of the dangers of long-term space travel?
9. What are the current rovers on Mars searching for?
10. What would be the best landing site on Mars and why?



Pre-Conference Requirements

Teacher's Page with suggested answers: Answers to Pre and Post Assessment Questions

How big do dust storms get on Mars?

Dust storms on Mars are much larger than they are on Earth and can completely cover the entire planet.

What is the name of the largest canyon on Mars?

Valles Marinaris is 2500 miles (4000 km) long, 310 miles (500 km) wide by 4.3 miles (7 km) deep. If this canyon system existed on Earth, it would stretch from San Francisco to Boston: essentially the entire length of the United States.

How come volcanoes can grow so large on Mars?

Two reasons: a) lack of surface gravity and b) lack of plate movement

What are the names of the two current rovers exploring Mars?

Spirit and Opportunity- NASA conducted an essay contest to name the rovers. The winner was Sofi Collis, a 9 year old from Scottsdale, AZ.

What are the average temperatures on the red planet?

The average surface temperature on Mars is a frigid minus 81 degrees Fahrenheit (-62.77 degrees Celsius) with extremes that range from 75 degrees Fahrenheit (23.88 Celsius) to less than minus 100 degrees Fahrenheit (-73.33 Celsius). In comparison, Earth's average surface temperature is about 58 degrees Fahrenheit (14.4 degrees Celsius).

What are some of the similarities between Earth and Mars?

A rotation rate of 24 hours 37 min (Earth: 23 hours 56 min.). Mars has an axial tilt of 24 degrees (Earth 23.5 degrees). It has a gravitational pull one-third of Earth's. It is close enough to the sun to experience seasons. Mars is about 50 percent farther from the sun than Earth.

How long would a trip to Mars take with current technology?

Roughly 6 to 8 months.

What are some of the dangers of long-term space travel?

Some dangers include exposure to solar radiation, loss of bone density during long-term space travel and life-support such as food for long periods of time.

What are the current rovers on Mars searching for?

The current rovers are searching for evidence of past signs of water on Mars. They are also trying to search for the mineral hematite which is formed in the presence of water.

What would be the best landing site on Mars?

A good example of a landing site is one that is relatively flat and in the case of the current rovers a crater site where exposure of layers can be easily identified.



Video Conference I Guidelines

Audience Guidelines

Teachers, please review the following points with your students prior to the event:

- Videoconference is a two-way event. Students and NASA presenters can see and hear one another.
- Students are sometimes initially shy about responding to questions during a distance learning session. Explain to the students that this is an interactive medium and we encourage questions.
- Students should speak in a loud, clear voice. If a microphone is placed in a central location instruct the students to walk up and speak into the microphone.
- Teacher(s) should moderate students' questions and answers.

Teacher Event Checklist

Date Completed	Pre-Conference I Requirements
	1. Print a copy of the module.
	2. Have the students complete the online pre-assessment.
	3. Email questions for the presenter. This will help focus the presentation on the groups' specific needs.
	4. Review the Audience Guidelines, which can be found in the previous section.
	Day of the Conference I Requirements
	1. The students are encouraged to ask the NASA presenter qualifying questions about the Challenge.
	2. Follow up questions can be continued after the conference through e-mail.
	Post - Conference I Requirements
	1. Have the students begin their research, construction, and testing phases of the Challenge.
	2. Use the provided rubric as guidelines for content and presentation criteria.
	3. Students can continue to e-mail questions to the NASA presenters about the Challenge and its criteria as they arise.



Introduction to Challenge Videoconference Outline

Introduction to Challenge Videoconference

Join NASA in this unique design challenge where students design their very own Crew Exploration Vehicle or pinpoint the safest and best location for a Mars landing. You will have the opportunity to get an in depth look at how current NASA scientists are approaching the very same problems. So hop aboard and join us as we brief your students to meet their objective of producing a successful mission to Mars. Experience the team planning and design challenges needed to carry through a design for a successful mission in the world of planetary exploration.

Outline for Video Conference One

- I. Welcome**
- II. Introduction**
- III. Moon History**
- IV. Mars**
- V. Earth and Mars Comparison**
- VI. Introduction to Challenge Team 1**
 - a. Time, Distance, Speed
 - b. Food and Health
 - c. Propulsion and Payload
 - d. Design
 - e. Decent and Landing
- VII. Introduction to Challenge Team 2**
 - a. Location site
 - b. Justify site
 - c. Geology
 - d. Mobility and Topography
 - e. Weather
- VIII. Rovers and EDL**
- IX. Careers**
- X. Q&A**
- XI. Classroom Resources**
- XII. Good-Bye**



In-Class Research-Design Activities

“Our aspirations are our possibilities”

Dr. Samuel Johnson 1709-1784 English Essayist

Here is your Challenge:

Produce a design or model of your newly designed Crew Exploration Vehicle (Team #1 CEV) or a topographic map (Team #2), showing an ideal place to land on Mars. Additionally your models will have to meet the criteria and constraints partially listed below. Your Challenge is open-ended and involves a variety of collaborative and creative problem solving efforts!

As part of your challenge, you will need to accomplish the following tasks:

- Research the history and efforts of space flights to the Moon, International Space Station and Mars to aid you in your development.
- Design what your model will look like and be able to validate your model.
- Determine and gather the materials you will need to successfully build your model.
- Obtain the most efficient model in terms of cost, weight and payload.
- Demonstrate your understanding and success to NASA.

Guidelines

*The students should understand that **criteria** are standards or requirements that the device must include. Examples of criteria are that the device must be efficient, must be able to land gently, and must be able to glide a certain distance.*

***Constraints** are things that limit the design of the CEV or map. Examples of constraints are money, time, maximum size, available materials, space to build or fly, and human capabilities.*

1. Write the words “criteria and constraints” on the board. Ask students to define the terms. Explain that when designing any device, the inventor-engineer must consider criteria and constraints.
2. Under the title: “Team 1 CEV Team Criteria” write the following:
 - a. The team must calculate time, distance and speed.
 - b. The team must use a propulsion that has been used before or that is currently being developed.
 - c. The team must include topics of food and health support on their CEV for long-term space flight.
 - d. The team must justify their design and payload capabilities.
 - e. Teams will prepare a final presentation of results and understanding based on the scoring rubric.

3. Under the title: “Team 2 Landing Site Team Criteria” write the following:
 - a. The team must contain all major geological features of Mars in their model.
 - b. The team must validate their decision in choosing the landing site.
 - c. The team must consider past mission to mars and their landing sites into their presentations.
 - d. The team must report mineral content on the landing site they choose.
 - e. The team must report temperature range, climate and habitat information.
 - f. Teams will prepare a final presentation of results and understanding based on the scoring rubric.
4. Under the title: “Model Design Constraints for both teams” write the following:
 - a. There are no material constraints.
 - b. There will be a working-researching-design time limit set by the classroom teacher.
 - c. Final team presentations will be limited by time, depending on the number of total presentations. Usually 5 to 6 minutes.
5. Using provided or any additional resources students can begin background research, gathering materials, designing, and construction.

Peer Evaluations

1. After student teams have completed their research and models, have the two teams switch model plans and evaluate each other’s proposals.
2. In this evaluation process, the groups should focus on whether the design meets the criteria and constraints up to this point and to offer any constructive criticisms or suggestions that would lead to greater success.
3. Once the groups have shared their evaluations, discuss as a class what the students learned from this peer evaluation. Lead a discussion using the following questions:
 - a. Did your model design meet the criteria and constraints?
 - b. What changes would you make and why?
 - c. What helpful comments did you get from the other group?
4. Explain to the students that an important part of the design process is revising the models prior and even after the presentation.



Pre-Classroom Activities

TEAM #1 Pre-Classroom Activity – Navigation and Trajectory

LESSON ONE GETTING THERE!

NAVIGATION AND TRAJECTORY

Open The Laptop

As a team, discuss the mission objectives for the actual path. Consider the following questions:

- What is the mission objective?
- What is the mission objective?
- What is the mission objective?

Activity One

DANCING WITH THE PLANETS

Student Procedures

1. Review the mission objectives for the actual path.
2. Review the mission objectives for the actual path.
3. Review the mission objectives for the actual path.

Teacher's Role

Facilitate the discussion and ensure that the mission objectives are understood.

Activity Two

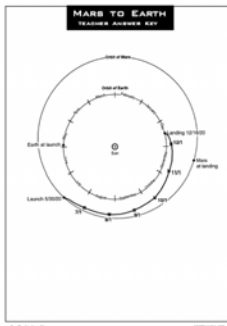
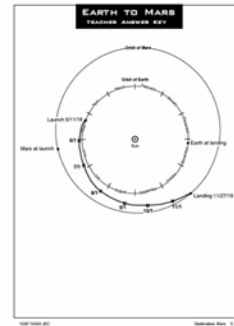
NAVIGATING THE PATH OF SPACECRAFT

Student Procedures

1. Review the mission objectives for the actual path.
2. Review the mission objectives for the actual path.
3. Review the mission objectives for the actual path.

Teacher's Role

Facilitate the discussion and ensure that the mission objectives are understood.



STUDENT PROCEDURES

DANCING WITH THE PLANETS

Student Procedures

1. Review the mission objectives for the actual path.
2. Review the mission objectives for the actual path.
3. Review the mission objectives for the actual path.

Teacher's Role

Facilitate the discussion and ensure that the mission objectives are understood.

STUDENT PROCEDURES

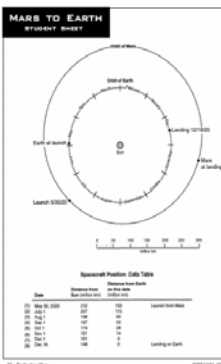
PLOTTING THE PATHS OF SPACECRAFT

Student Procedures

1. Review the mission objectives for the actual path.
2. Review the mission objectives for the actual path.
3. Review the mission objectives for the actual path.

Teacher's Role

Facilitate the discussion and ensure that the mission objectives are understood.



To get this Pre-Classroom Activity, please click on this PDF file.

<http://ares.jsc.nasa.gov/Education/activities/destmars/DestmarsLes1.pdf>

If you can't link directly from here, copy and paste the address into your browser.

Mars Rover Egg Drop and Landing (EDL)

TEAM #2 Pre-Classroom Activity EDL

National Science Education Standards:

Standards A: Abilities of inquiry science

Standards E: Abilities of technological design.

National Technology Education Standards:

NT.K-12.3 Technology Productivity Tools

NT.K-12.6 Technology Problem-Solving and Decision-Making Tools

Materials:

1 cereal box, 4 balloons, 5 m of string, newspaper,
1 egg, tape, scissors, ruler, pencil, hole punch

Lander

1. Starting with a cereal box, unfold the box
2. On one side of the box, trace an equilateral triangle, 22 cm (8.5in) on a side
3. Cut out the triangle and punch a single hole near each vertex.
4. Fold the triangle into a tetrahedron to form a “Lander”.
5. Place the egg inside the tetrahedron and tape closed along each seam.
6. Tie a 1-m (40 in) piece of string through the holes at the vertices.

Parachute

1. Unfold a large piece of newspaper.
2. Cut off the edge of the newspaper sheet to form a square.
3. Cut off each corner of the square to form an octagon.
4. Using four 1-m (40 in) pieces of string, tape each end of each of string to adjacent corners of the octagon parachute.

Air Bags

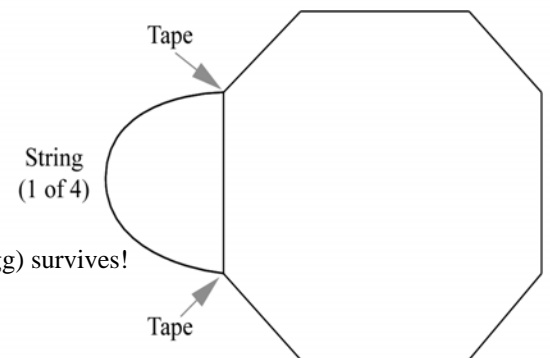
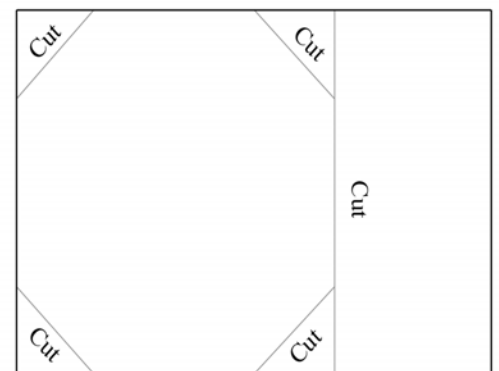
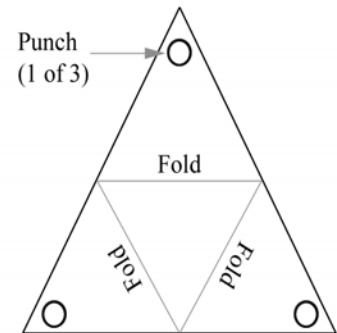
1. Inflate four 25-cm (10 in) balloons.
2. Using tape rolled back on itself, tape each balloon to each face of the lander.
3. Gather the four strings on the parachute and tie them to the string on the lander.

Entry, Descent and Landing (EDL)

Drop your “pathfinder” from a high place and see if your payload (egg) survives!

For further information visit:

<http://marsweb.jpl.nasa.gov/classroom/pdfs/MSIP-MarsActivities.pdf>





Content and Presentation Rubric

Student Team Presentations

Student teams are selected to present to NASA's DLN

- Classroom Teachers and NASA Educational Host, along with Rubric results, can be used to determine which student teams will present their results during the second DLN connection.
- The remaining student teams will be passive participants.

Student Presentation Requirements

- Each team has 5 to 6 minutes to present the following items and information:
 - The actual experimental CEV or topographic map
 - Team 1 must provide time, distance and speed calculations.
 - Team 2 must provide major geologic features, temperature and mineral composition of landing site.
 - Description of problems and successes during design process.
 - Adhere to all objectives in the rubrics.

Digital Learning Network

Mission to Mars Challenge Team #1



Name: _____

Teacher: _____

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
TEAM 1 - TIME, DISTANCE AND SPEED	Students mention all portions but do not explain objective.	Students mentioned only one portion of this objective	Students mentioned only two portions of this objective.	Students calculated; 1)their speed 2)distance from Mars 3)Time to reach destination	_____
TEAM 1 - PROPULSION	Students did not mention current or future means of propulsion.	Students explained choice of propulsion but offered no benefits.	Students explained choice of propulsion and listed one benefit.	Students explained choice of propulsion and listed two or more benefits.	_____
TEAM 1 - FOOD & HEALTH	Students gave one countermeasure on how they would solve food and health problems on their journey.	Students gave two countermeasures on how they would solve both food and health problems on their journey.	Students included countermeasures but did not include them in their CEV design	Students stated two or more countermeasures for both food and health and incorporated them into their CEV model.	_____
TEAM 1 - DESIGN & PAYLOAD	Students mentioned both of these objectives but did not justify them.	Students supported one of the objectives but not the other.	Students must justify their design and payload capabilities by supporting it with one reason for each objective.	Students must justify their design and payload capabilities by supporting it with two or more reasons for each objective.	_____
TEAM 1 - DESCENT & LANDING	Students displayed limited knowledge about their landing site on the surface of Mars.	Students talked about how they would land on the surface of Mars but did not justify it	Students stated how they would land and referenced past missions to Mars.	Students stated all of the above and stated whether their CEV would land directly on the surface or send a secondary craft to the surface.	_____
				Total---->	_____

Teacher Comments:

Digital Learning Network

Mission to Mars Challenge Team #2



Name: _____

Teacher: _____

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
TEAM 2- Major Geological Features of Mars	Student's model contains at least two major geological features.	Students model contains at least three major geological features	Students model contains at least four major geologic features	Students model contains all of the previous and is labeled and contains previous landing sites as well	_____
TEAM 2- Validity in choosing landing site	Students did not provide sufficient reasons for choosing a specific landing site	Students gave limited reasons as to why they choose a specific landing site	Student gave at least three reasons for choosing a specific landing site	Student gave at least four well thought out answers as to their landing site.	_____
TEAM 2- Reference to previous missions landing sites	Students did not mention any previous missions to Mars or their landing sites.	Students mentioned at least one past mission to mars and its landing site.	Students mentioned at least two past missions to Mars and its landing site.	Students not only reference past missions landing sites but also gave specific reasons.	_____
TEAM 2- Temperature, Climate and Habitat information	Students did not mention specific information on Temperature, Climate and Habitat objective	Students mentioned only one portion of the objective	Students mentioned two portions of the objective	Students gave specific on all portions of this objective	_____
TEAM 2- Mineral content of their landing site	Students did not mention this objective.	Students provided limited information on the mineral content of their landing site.	Students provided accurate information on the mineral content of their landing site.	Students provided information and benefits of mineral content	_____
				Total---->	_____

Teacher Comments:

Digital Learning Network

FINAL STUDENT PRESENTATION AND CONTENT



Name: _____

Teacher: _____

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
Voice Projection- Volume Speed, Articulation, Lack of filler words (um,uh)	Consistently uses a monotone voice.	Displays some level of inflection throughout delivery.	Satisfactory use of inflection, but does not consistently use fluid speech.	Use of fluid speech and inflection, maintains the interest of the audience.	_____
Poise and Body Gestures- Appropriate to presentation	Tension and nervousness is obvious; has trouble recovering from mistakes.	Displays mild tension; has trouble recovering from mistakes.	Makes minor mistakes but quickly recovers from them; displays little or no tension.	Student displays relaxed, self-confident nature about self, with no mistakes.	_____
Pacing and Time- Set by NASA Host- Usually 4-6 min	Delivery is either too quick or too slow to meet apportioned time interval.	Delivery is in bursts and does not meet apportioned time interval.	Delivery is patterned, but does not meet apportioned time interval.	Good use of drama and student meets apportioned time interval.	_____
Visual support and Model	Student has model but does not give insight to support it.	Student has a good model and provides limited insight to support it.	Student model contains greater detail and students gives insight to support it	Student model is well done and explanations are clear and concise.	_____
Introduction and Closure	Student does not display clear introductory or closing remarks.	Delivery clearly uses either an introductory or closing remark, but not both	Student displays clear introductory and closing remarks	Students deliver open and closing remarks that capture the attention of the audience.	_____
				Total---->	_____

Teacher Comments:



Presentation of Student Solutions Videoconference Outline Guidelines

Audience Guidelines

Teachers, please review the following points with your students prior to the event:

- Videoconference is a two-way event. Students and NASA presenters can see and hear one another.
- Students are sometimes initially shy about responding to questions during a distance learning session. Explain to the students that this is an interactive medium and we encourage questions.
- Students should speak in a loud, clear voice. If a microphone is placed in a central location instruct the students to walk up and speak into the microphone.
- Teacher(s) should moderate students' questions and answers.

Teacher Event Checklist Presentation of Student Solutions Videoconference

Date Completed	Pre-Conference II Requirements
	1. Review the Audience Guidelines, which can be found in the previous section.
	2. Students should use the content and presentation rubric as guidelines for final presentations to the NASA presenters.
	3. Students should have their final solutions prepared for a timed formal presentation.
	4. Using a variety of presentation methods (oral, visual, ppt, mpeg, video, charts, etc) students should practice and time their presentations.
	Day of the Conference II Requirements
	1. The students will be asked to share their results from their pre-conference lesson with the NASA presenters.
	2. Bring any materials to help support the student presentations.
	Post - Conference II Requirements
	1. Have the students take the online Post-Assessment to demonstrate their knowledge of the subject.
	2. Teacher(s) and students fill out the event feedback.



Presentation of Student Solutions

Videoconference Outline

Student Challenge Presentation Videoconference

Student teams with the highest rubric scores as evaluated by your teacher will have the opportunity to make a 5 to 6 minute visual-oral presentation to NASA's Digital Learning Network team. They will demonstrate their results, understanding of team challenge, and problem solving process.

- I. Introduction**
- II. Welcome**
- III. Videoconference Objectives**
 - a. Overview of Challenge**
 - b. Demonstrate knowledge and results in a presentation**
 - c. Experience the Complexity and Excitement of the design process**
- IV. Review of Challenge**
- V. Presentation Requirements**
- VI. Follow up questions by NASA Host**
- VII. Closing Remarks**
- VIII. Good-Bye**



Post-Conference

Online Post-Assessment

After the event students will need to take the online post-conference assessment. (These questions are the same questions used in the pre-assessment.) The short assessment will help us measure student learning and identify any changes that need to be made in future programs.

Post-Conference Assessment Questions

1. How big do dust storms get on Mars?
2. What is the name of the largest canyon on Mars?
3. How come volcanoes can grow so large on Mars?
4. What are the names of the two current rovers exploring Mars?
5. What are the average temperatures on the red planet?
6. What are some of the similarities between Earth and Mars?
7. How long would a trip to Mars take with current technology?
8. What are some of the dangers of long-term space travel?
9. What are the current rovers on Mars searching for?
10. What would be the best landing site on Mars and why?



NASA Education Evaluation Information System (NEEIS)

Please complete an online evaluation form to provide feedback on the NASA Challenge.

Feedback from you and a few of your students would be appreciated.

<http://nasadln.nmsu.edu/dln/content/feedback/>

Digital Learning Network

Certificate of Completion

This certifies that

*Has completed NASA's
Mission to Mars Challenge*

Instructor





Vocabulary

Adaptation: adjustments in an organism or its parts to help it live in its environment.

Aerobraking: The use of atmospheric drag to slow a spacecraft.

Atmosphere: The gaseous mass or envelope surrounding a celestial body, especially the one surrounding the earth, and retained by the celestial body's gravitational field.

Axis of rotation: The straight line, or imaginary, passing through a rotating body and is the line about which that body rotates.

Composition: the general makeup or characteristics of material such as rock or soil.

Deploy: To bring (forces or material) into action. To distribute (persons or forces) systematically or strategically.

Descent: The act or an instance of descending. A way down. A downward incline. or passage; a slope.

Eruption: the outflow of hot lava and other materials like ash from a volcano or crack in rock.

Escape velocity: the speed that any object must acquire in order to escape from a planet's gravitation.

Gravity: The natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body.

Habitat: the natural place where an organism lives, including the surrounding environment.

Kilometer: A metric unit of length equal to 1,000 meters (0.62 mile).

Payload: The total weight of passengers and cargo that an aircraft carries or can carry. The total weight of the instruments, crew, and life-support systems that a spacecraft carries or can carry. The passengers, crew, instruments, or equipment carried by an aircraft, spacecraft, or rocket.

Retro-rocket: A rocket engine used to retard, arrest, or reverse the motion of a vehicle, such as an aircraft, missile, or spacecraft. A small rocket engine on a larger rocket or spacecraft that is fired to slow or alter its course.

Simulation: Imitation or representation, as of a potential situation or in experimental testing. Representation of the operation or features of one process or system through the use of another: computer simulation of an in-flight emergency.

Stratigraphy: layers of rock, often as viewed sideways like a stack of pancakes.

Trajectory: the curving path of a spacecraft.

Name _____

Date _____

Mars Challenge Vocabulary

P	R	T	D	T	T	G	E	P	I	P	T	T	S	N	K	A	B	E	E	O	C	P	I	L
A	N	N	I	G	N	O	S	T	T	G	R	M	Y	A	D	O	T	B	A	S	N	R	R	A
R	M	S	A	R	I	G	O	T	V	R	S	O	I	U	R	T	L	I	A	P	N	E	P	O
E	C	N	I	M	I	P	R	E	R	I	A	M	T	L	E	D	E	L	E	E	N	A	N	O
O	T	K	I	M	R	T	T	A	S	A	N	J	O	T	A	L	E	I	I	T	Y	A	E	Y
T	L	O	D	I	U	P	T	Y	V	C	T	T	E	E	D	H	A	E	C	L	D	E	R	R
N	C	O	E	O	S	L	A	N	N	I	A	I	A	C	T	T	R	R	O	L	A	P	L	D
A	T	F	A	Y	A	T	A	A	V	Y	T	P	G	N	T	N	A	A	A	I	K	E	P	A
B	P	S	O	O	A	I	T	T	E	T	T	Y	E	R	O	O	D	T	O	A	T	D	N	A
D	R	A	R	N	N	Y	T	R	I	D	O	H	V	V	A	I	R	E	I	R	I	D	A	N
A	A	T	I	I	O	T	N	M	E	O	T	S	A	E	E	P	T	Y	D	B	U	S	T	X
B	L	Y	A	V	L	O	I	O	A	C	N	C	J	T	T	L	H	I	S	A	A	Y	D	R
T	E	I	O	A	X	L	G	O	I	O	R	T	A	K	P	N	O	Y	S	V	T	H	H	P
L	I	R	T	L	E	N	D	C	O	T	E	T	E	G	A	R	Y	C	N	O	A	O	T	S
P	R	O	E	E	P	S	R	B	T	K	A	T	M	I	N	E	E	A	I	E	P	E	P	A
S	P	A	A	N	C	E	R	E	C	B	I	T	I	K	N	I	I	P	R	T	R	M	A	Y
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T	I	P	E	L	I	B	R	P	Y	E	L	D	I	R	A	A	T	A	H	F	D	R	N	C
P	A	D	R	A	T	O	M	G	H	A	D	T	O	E	F	E	A	P	R	N	A	O	O	N
H	A	M	E	T	R	O	D	B	Y	E	A	O	R	R	M	O	S	T	E	B	I	T	T	O
T	L	I	R	T	A	P	A	O	S	T	T	O	T	O	C	O	S	A	L	T	O	E	E	I
O	N	I	E	T	T	I	M	C	P	E	I	R	L	T	M	R	E	I	P	O	I	R	E	R
O	R	R	O	A	T	I	E	A	O	O	O	I	E	T	O	R	T	U	X	R	T	G	E	A
C	A	A	T	I	L	N	D	K	N	J	K	O	A	U	M	C	R	E	I	A	O	I	M	A
X	C	E	E	E	T	A	A	A	E	P	N	R	S	A	P	E	O	T	C	N	H	I	E	R

Adaptation

Aero braking

Atmosphere

Axis of Rotation

Composition

Deploy

Descent

Eruption

Escape Velocity

Gravity

Habitat

Kilometer

Payload

Retrorocket

Simulation

Stratigraphy

Trajectory

Word Scramble

Name _____

Digital Learning Network

Date _____

Science

Mars Challenge Vocabulary

Unscramble the words below:

1. jeTorcatry_____

2. cke-rrRoteot_____

3. eeorilmtK_____

4. yiravtG_____

5. noipoCstiom_____

6. dottpainAa_____

7. tsDnece_____

8. rinkgeabAor_____

9. RfoinsAiatotox_____

10. pthatrgSaiyr_____

11. tiHtbbaa_____

12. atEcspoeVyelic_____

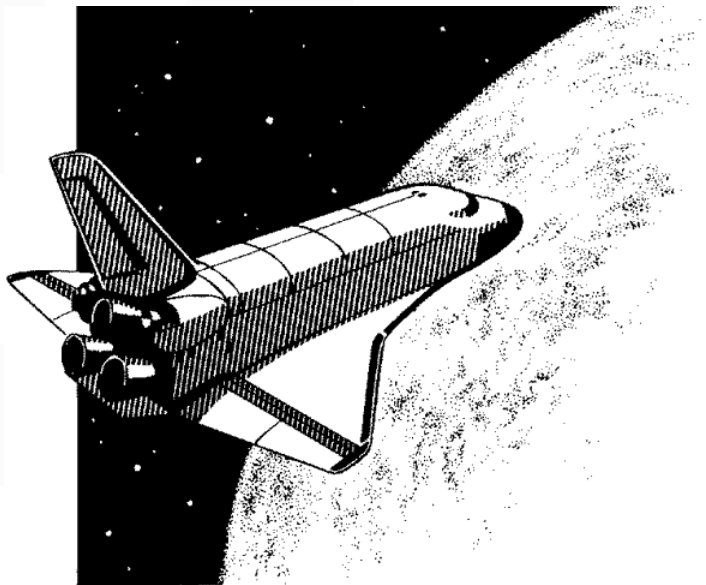
13. ayPaodl_____

14. onriputE_____

15. tuiaiolmnS_____

16. pelDoy_____

17. tpAhmreose_____



Word Scramble

Mars Challenge Vocabulary

Answers

1. jeTorcatry is Trajectory.
2. cke-rrRoteot is Retro-rocket .
3. eeorilmtK is Kilometer.
4. yiravtG is Gravity .
5. noipoCstiom is Composition.
6. dottpainAa is Adaptation.
7. tsDnece is Descent.
8. rinkgeabAor is Aerobraking.
9. RfoinsAiatotox is Axis of Rotation .
10. pthatrgSaiyr is Stratigraphy.
11. tiHtbaa is Habitat.
12. atEcspoeVyellic is Escape Velocity .
13. ayPaodl is Payload.
14. onriputE is Eruption.
15. tuiaiolmnS is Simulation.
16. pelDoy is Deploy.
17. tpAhmreose is Atmosphere.



Resources

CEV Information and Designs (Grade 6-12)

This website provides information and considerations when designing a CEV.

<http://www.spacedaily.com/news/nasa-04zn.html>

Information of Past missions to Mars (Grades 5-8 and 9-12)

All you need to know about Mars with mission updates. Be sure to check out M2K4 under Exploration rovers.

<http://mars.jpl.nasa.gov/>

USGS Planetary Maps (Grades 6-12)

Find everything you need to know about selecting your landing site and get topographic and geology maps of Mars. Zoom in for a closer look and be sure to get the longitude and latitude coordinates as well.

<http://planetarynames.wr.usgs.gov/mars/marsTOC.html>



Background Information

Earth/Mars Comparison

	Mars	Earth
Average Distance from Sun	142 million miles	93 million miles
Average Speed in Orbiting Sun	14.5 miles per second	18.5 miles per second
Diameter	4,220 miles	7,926 miles
Tilt of Axis	25 degrees	23.5 degrees
Length of Year	687 Earth Days	365.25 Days
Length of Day	24 hours 37 minutes	23 hours 56 minutes
Gravity	.375 that of Earth	2.66 times that of Mars
Temperature	Average -81 degrees F	Average 57 degrees F
Atmosphere	mostly carbon dioxide some water vapor	nitrogen, oxygen, argon, others
# of Moons	2	1



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